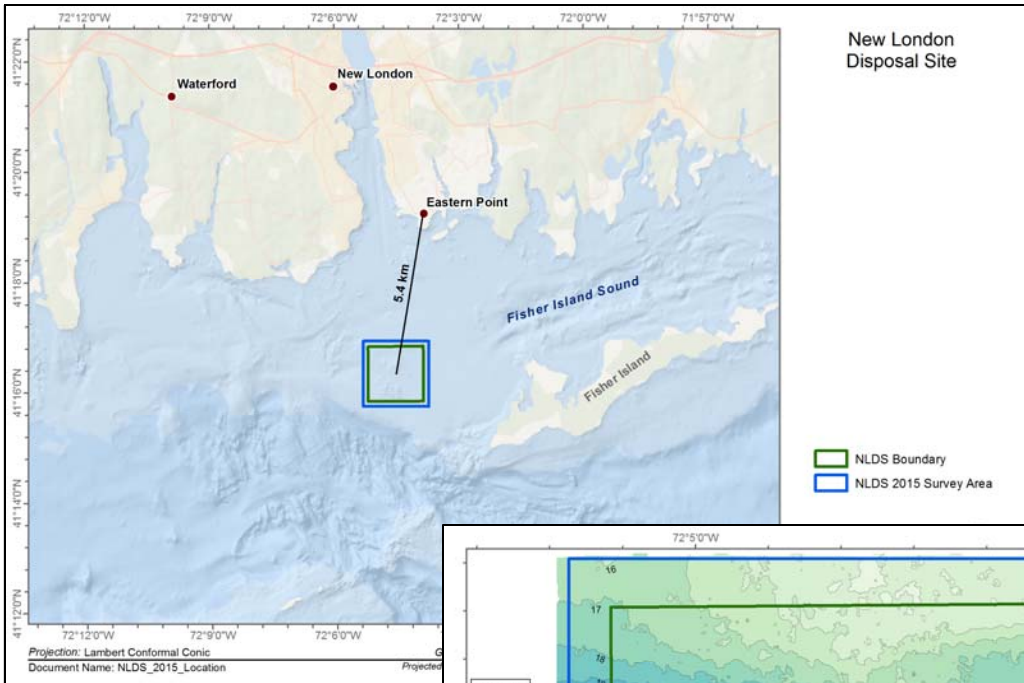
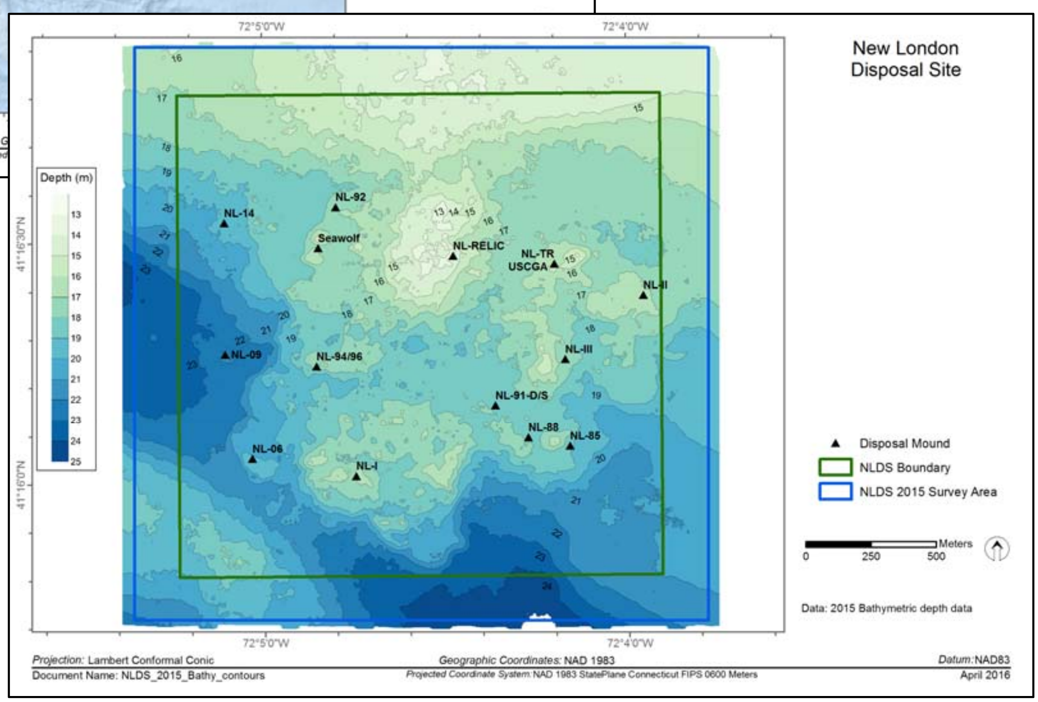
Data Summary Report for the Monitoring Survey at the New London Disposal Site - October 2015

Disposal Area Monitoring System DAMOS





Data Summary Report
DR 2015-04
February 2017

US Army Corps of Engineers®
New England District

DAMOS
DISPOSAL AREA MONITORING SYSTEM

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<u>Note on units of this report</u>: As a scientific data summary, information and data are presented in the metric system. However, given the prevalence of English units in the dredging industry of the United States, conversions to English units are provided for general information in Section 1. A table of common conversions can be found in Appendix A.

DATA SUMMARY REPORT FOR THE MONITORING SURVEY AT THE NEW LONDON DISPOSAL SITE - OCTOBER 2015

February 2017
DR 2015-04

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New England District
U.S. Army Corps of Engineers
696 Virginia Road
Concord, MA 01742-2751

Prepared by:
Drew A. Carey, DAMOSVision
S. Kersey Sturdivant, DAMOSVision
Ellen Bellagamba Fucile, DAMOSVision

Submitted by:
Battelle
141 Longwater Drive, Suite 202
Norwell, MA 02061

and

DAMOSVision
215 Eustis Avenue
Newport, RI 02840

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Drew Carey, S. Kersey Sturdivant, Bellagamba Fucile, E.

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
DAMOSVision
215 Eustis Avenue
Newport, RI 02840

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13. ABSTRACT

A monitoring survey was conducted at the New London Disposal Site (NLDS) in October 2015 as part of the U.S. Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program.

The 2015 NLDS acoustic monitoring survey was a confirmatory study over the entire site.

NLDS is an active open-water dredged material disposal site located near the mouth of Long Island Sound in Fishers Island Sound. The site is approximately 5.4 km (2.9 nmi) south of Eastern Point, Groton, Connecticut and is centered at 41° 16.306´ N, 72° 04.571´ W (NAD83; Figure 1-1). The disposal site covers a 3.42-km² (1.32-mi²) area of seafloor, with water depths that range from 13.4 m (43 ft) over a relic mound in the north central portion of the site, to 24.3 m (79 ft) at its deepest point at the southern disposal site boundary (Figure 1-2). Two important management boundaries are present at NLDS: a 300-m (984-ft) wide submarine transit corridor, crossing through the center of NLDS from south to north, and the New York-Connecticut state boundary, crossing the southeast corner of the site (Figure 1-1). The submarine corridor was established to minimize conflict between disposal buoy positions and submarine traffic to and from the U.S. Navy Base in Groton, CT. The state boundary affects state regulatory authority under the Coastal Zone Management Act (CZMA) and the issuance of state water quality certification (Clean Water Act, Section 401) for disposal permits (Carey 1998).

Currently, this site is utilized for the placement of dredged material deemed suitable for open water disposal. Most of the material generated from dredging operations in the eastern Long Island Sound region is transported by barge and deposited at NLDS. Historical disposal mounds form topographic highs that vary from 2 to 6 m (6-20 ft) shallower than the majority of the surrounding seafloor depths (Figure 1-2).

The objective of the 2015 survey was to characterize the seafloor topography and surface features over the entire NLDS using high-resolution acoustic bathymetry.

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LIST OF ACRONYMS

ASCII	American Standard Code for Information Interchange
CCOM	Center for Coastal and Ocean Mapping
CI	Confidence interval
CZMA	Coastal Zone Management Act
DAMOS	Disposal Area Monitoring System
DGPS	Differential global positioning system
FIPS	Federal Information Processing Standard
GIS	Graphic information system
GPS	Global positioning system
MBES	Multibeam echosounder
MLLW	Mean lower low water
MRU	motion reference unit
NAD83	North American Datum (1983)
NAE	New England District
NLDS	New London Disposal Site
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NTRIP	Network transport of data over IP
PV	Plan-view (imaging)
RTK	Real time kinematic GPS
SHP	Shapefile or geospatial data file
SOP	Standard Operating Procedures
SPI	Sediment-profile imaging
TIF	Tagged image file
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1.0 INTRODUCTION

A monitoring survey was conducted at the New London Disposal Site (NLDS) in October 2015 as part of the U.S. Army Corps of Engineers (USACE) New England District (NAE) Disposal Area Monitoring System (DAMOS) Program. DAMOS is a comprehensive monitoring and management program designed and conducted to address environmental concerns surrounding the placement of dredged material at aquatic disposal sites throughout the New England region. An overview of the DAMOS Program and NLDS is provided below.

1.1 Overview of the DAMOS Program

The DAMOS Program features a tiered management protocol designed to ensure that any potential adverse environmental impacts associated with dredged material disposal are promptly identified and addressed (Germano et al. 1994). For over 39 years, the DAMOS Program has collected and evaluated disposal site data throughout New England. Based on these data, patterns of physical, chemical, and biological responses of seafloor environments to dredged material disposal activity have been documented (Fredette and French 2004).

DAMOS monitoring surveys fall into two general categories: confirmatory studies and focused studies. The data collected and evaluated during these studies provide answers to strategic management questions in determining the next step in the disposal site management process to guide the management of disposal activities at existing sites, plan for use of future sites, and evaluate the long-term status of historic sites.

Confirmatory studies are designed to test hypotheses related to expected physical and ecological response patterns following placement of dredged material on the seafloor at established, active disposal sites. Two primary goals of DAMOS confirmatory monitoring surveys are to document the physical location and stability of dredged material placed into the aquatic environment and to evaluate the biological recovery of the benthic community following placement of dredged material. Several survey techniques are employed in order to characterize these responses to dredged material placement. Sequential acoustic monitoring surveys (including bathymetric, acoustic backscatter, and side-scan sonar data collection) are performed to characterize the height and spread of discrete dredged material deposits or mounds created at open water sites as well as the accumulation/consolidation of dredged material into confined aquatic disposal cells.

Sediment-profile (SPI) and plan-view (PV) imaging surveys are often performed in confirmatory studies to provide further physical characterization of the material and to support evaluation of seafloor (benthic) habitat conditions and recovery over time. Each type of data collection activity is conducted periodically at disposal sites and the conditions found after a defined period of disposal activity are compared with the long-term data set at specific sites to determine the next step in the disposal site management process (Germano et al. 1994).

Focused studies are periodically undertaken within the DAMOS Program to evaluate inactive or historical disposal sites and contribute to the development of dredged material placement and monitoring techniques. Focused DAMOS monitoring surveys may also feature additional types of data collection activities as deemed appropriate to achieve specific survey objectives, such as subbottom profiling, towed video, sediment coring, or grab sampling. The 2015 NLDS acoustic monitoring survey was a confirmatory study over the entire site.

1.2 Introduction to the New London Disposal Site (NLDS)

NLDS is an active open-water dredged material disposal site located near the mouth of Long Island Sound in Fishers Island Sound. The site is approximately 5.4 km (2.9 nmi) south of Eastern Point, Groton, Connecticut and is centered at 41° 16.306´ N, 72° 04.571´ W (NAD83; Figure 1-1). The disposal site covers a 3.42-km² (1.32-mi²) area of seafloor, with water depths that range from 13.4 m (43 ft) over a relic mound in the north central portion of the site, to 24.3 m (79 ft) at its deepest point at the southern disposal site boundary (Figure 1-2). Two important management boundaries are present at NLDS: a 300-m (984-ft) wide submarine transit corridor, crossing through the center of NLDS from south to north, and the New York-Connecticut state boundary, crossing the southeast corner of the site (Figure 1-1). The submarine corridor was established to minimize conflict between disposal buoy positions and submarine traffic to and from the U.S. Navy Base in Groton, CT. The state boundary affects state regulatory authority under the Coastal Zone Management Act (CZMA) and the issuance of state water quality certification (Clean Water Act, Section 401) for disposal permits (Carey 1998).

Currently, this site is utilized for the placement of dredged material deemed suitable for open water disposal. Most of the material generated from dredging operations in the eastern Long Island Sound region is transported by barge and deposited at NLDS. Historical disposal mounds form topographic highs that vary from 2 to 6 m (6-20 ft) shallower than the majority of the surrounding seafloor depths (Figure 1-2).

Management objectives are to minimize the lateral spread and the height of dredged material disposal mounds. Recent placement has taken advantage of the topography of the site through filling in depressions between historical disposal mounds. This approach has the dual advantage of maximizing site capacity while minimizing volumes of dredged material required to completely cover and contain dredged material requiring management for Connecticut water quality standards (Carey 1998). Additionally, in order to reduce the effects of bottom currents and storm-generated waves, sediment mounds at NLDS are developed in a broad, flat manner, maintaining a minimum water depth of 14 meters. This minimum depth also allows for the safe passage of deep draft U.S. Navy vessels transiting through the disposal site (NUSC 1979).

Previous studies have shown that NLDS is relatively protected from the effects of ocean storms due to the configuration of the surrounding landmasses (SAIC 2001a, O’Donnell et al. 2015). Fishers Island, located approximately 4 km to the east, and the south fork of Long Island protect the disposal site from storm-generated ocean waves emanating from the east and south respectively (Figure 1-1). The fetch-limited environment tends to buffer the development of large surface waves, which could cause resuspension of sediment and promote erosional conditions over the surface of the disposal mounds.

1.3 Historical Dredged Material Disposal Activity

Dredged material disposal has taken place at NLDS since 1955 and has been managed by the DAMOS Program since 1977 (SAIC 2001a). Material generated from dredging operations in the New London, CT region, including the Thames River, New London Harbor, U.S. Navy Pier, and various marinas, coves, yacht clubs and shipyards, is typically deposited at NLDS.

There are 13 discernible disposal mounds located within the boundaries of NLDS: NL-RELIC, NL-I, NL-II, NL-III, NL-85, NL-88, NL-TR, NL-91-D/S Mound Complex, USCGA, NL-92, NL-94/96, Seawolf, and NL-06 (Table 1-1; Figure 1-2).

1.4 Previous Monitoring Events at NLDS

In September 2014, a sediment-profile and plan-view imaging (SPI/PV) survey was conducted to define the physical characteristics of surficial sediments and assess the benthic community status of selected areas in NLDS and extending west up to, and including, the inactive historical Niantic Bay Disposal Site (Table 1-2; Carey and B. Fucile 2015). The SPI/PV survey was undertaken to support the U.S. Environmental Protection Agency's Supplemental Environmental Impact Statement to evaluate the potential designation of new Ocean Dredged Material Disposal Sites to serve the eastern Long Island Sound region (USEPA 2016). In July/August 2007 a full-site multibeam bathymetric survey was performed to document the distribution of dredged material within NLDS. A SPI/PV survey, combined with sediment grabs, was also conducted to assess benthic recolonization of the NL-06 Mound, the NL-91-D/S Mound Complex, and the USCGA Mound (AECOM 2009).

1.5 Recent Dredged Material Disposal Activity

Since the July 2007 survey approximately 155,000 m³ (204,000 yd³) of dredged material has been disposed at NLDS, primarily in the deeper western portion of the site near the western boundary during the 2009-2015 disposal seasons creating two newly designated mounds (Table 1-3; Figure 1-3). The majority of the dredged material (136,500 m³/178,500 yd³) originated from the Mystic River Federal Navigation Project during the 2014-1015 disposal season (Table 1-3). This dredged material was directed to an area designated as the NL-14 Mound. The remainder of the dredged material was placed in an area designated as the NL-09 Mound.

1.6 2015 Survey Objective

The objective of the 2015 survey was to characterize the seafloor topography and surface features over the entire NLDS using high-resolution acoustic bathymetry.

Table 1-1.

Overview of Historical Dredged Material Mounds

Mound	Season(s) Formed	Dredging Projects	Approximate Volume Dredged Material (m^3)	Notes	Reference (Contribution No.)
NL-RELIC, NL-I, NL-II, NL-III	Late 1970s, early 1980s	unknown	unknown	First master bathymetric survey - July 1986	Parker and Revelas 1989 (C60)
NL-85	1985 1987	Not specified Not specified	377,500 55,100		SAIC 1990a (C66)
NL-88	1987-1988 1988-1989	Not specified Noank and Mystic	104,000 21,200		SAIC 1990b (C71)
NL-TR	1988-1989 1990-1991	Thames Shipyard and Repair Company	72,803 31,475		Germano et al. 1995 (C93) SAIC 1995 (C96)
NL-91	1991-1992 2000-2005	Mystic and Niantic Rivers Misc. Marinas/Coves	8,800 28,500		AECOM 2009 (C180)
D/S	1991-1992	Dow Chemical Company and Stonington Harbor	95,300	NL-91 and D/S mound coalesced	AECOM 2009 (C180)
NL-91-D/S Mound Complex	1997-1998 1998-1999 5/2000	Dow Chemical Company and Stonington Harbor	6,850 22,210 1,375		AECOM 2009 (C180)
USCGA	1994-1995	U.S. Navy CAD Cells	124,000	180 m west of NL-TR	AECOM 2009 (C180)
NL-94/96	1994-1995 1996-1997 2006-2007	U.S. Navy Submarine Base Pier 15 Various Coves and Marinas	36,900 3,400 15,200	NL-94/96 abuts NL-1	SAIC 2001a (C128)
Seawolf	1995-1996	Thames and Mystic Rivers	877,500		SAIC 2003 (C149)
NL-06	2006-2007	Dow Chemical Company and U.S. Navy CAD Cells	277,000		AECOM 2009 (C180)

Table 1-2.

Overview of Previous Monitoring Surveys at NLDS since 1992

Date	Purpose of Survey	Bathymetry Area (m × m)	No. SPI Stations	No. Sediment Cores	No. Benthic Grabs	Additional Studies	Reference (Contribution No.)
August 1992	Monitoring	1600 × 1600	Site: 41 Ref: 39			DO Sampling	SAIC 2001a (C128)
August 1995	Monitoring	1600 × 1600	Site: 31 Ref: 15				SAIC 2001a (C128)
October 1995	Baseline (Seawolf)	1000 × 1000	-				SAIC 2001b (C132)
December 1995	Pre-cap (Seawolf)	1000 × 1000	-				SAIC 2001b (C132)
February 1996	Post-cap (Seawolf)	1000 × 1000	-				SAIC 2001b (C132)
September 1997	Monitoring	2100 × 2100 1000 × 1000 (Seawolf)	Site: 68 Ref: 13				SAIC 2001a (C128), SAIC 2001b (C132)
July 1998	Monitoring	1000 × 1000 (Seawolf)	Site: 42 Ref: 13	Site: 12 Ref: 1			SAIC 2001a (C128), SAIC 2001b (C132)
August 2000	Monitoring	800 × 800 (NL-91-D/S) 1000 × 1000 (Seawolf)	Site: 55 Ref: 13				SAIC 2001c (C133)
June 2001	Monitoring (Seawolf)	-	Site: 29 Ref: 13	Site: 12 Ref: 1	Site: 6		SAIC 2004 (152)
October 2002	Post-storm monitoring (Seawolf)	1000 × 1000	Site: 29 Ref: 13			Side-scan	SAIC 2003 (C149)
February 2003	Post-storm monitoring (Seawolf)	1000 × 1000	-				SAIC 2003 (C149)
July 2006	Monitoring (Seawolf)	2100 × 2100	Site: 13 Ref: 13	Site: 13 Ref: 1	Site: 12 Ref: 6		AECOM 2010 (C182)
July/August 2007	Monitoring	2100 × 2100	Site: 45 Ref: 15			1 Sediment Grab at NL-06	AECOM 2009 (C180)
September 2014	Reconnaissance	-	NLDS: 6 NBDS: 11 Transect: 27				Carey and B. Fucile 2015

Table 1-3.

Estimated Volume of Dredged Material Placed at NLDS
from January 2010 to January 2015 (from disposal logs provided by USACE, March 2016; Appendix B)

Placement Location	Project name	Disposal Season(s)	Load volume (m^3)	Load volume (yd^3)
NL-09	Niantic Dockominium Association	2009-2010	2,538	3,320
NL-09	Brewer Yacht and Dodson Boat Yards	2011-2013	10,698	19,134
NL-14	Mystic River Federal Navigation Project	2014-2015	136,422	178,433
		TOTAL	**153,589**	**200,887**

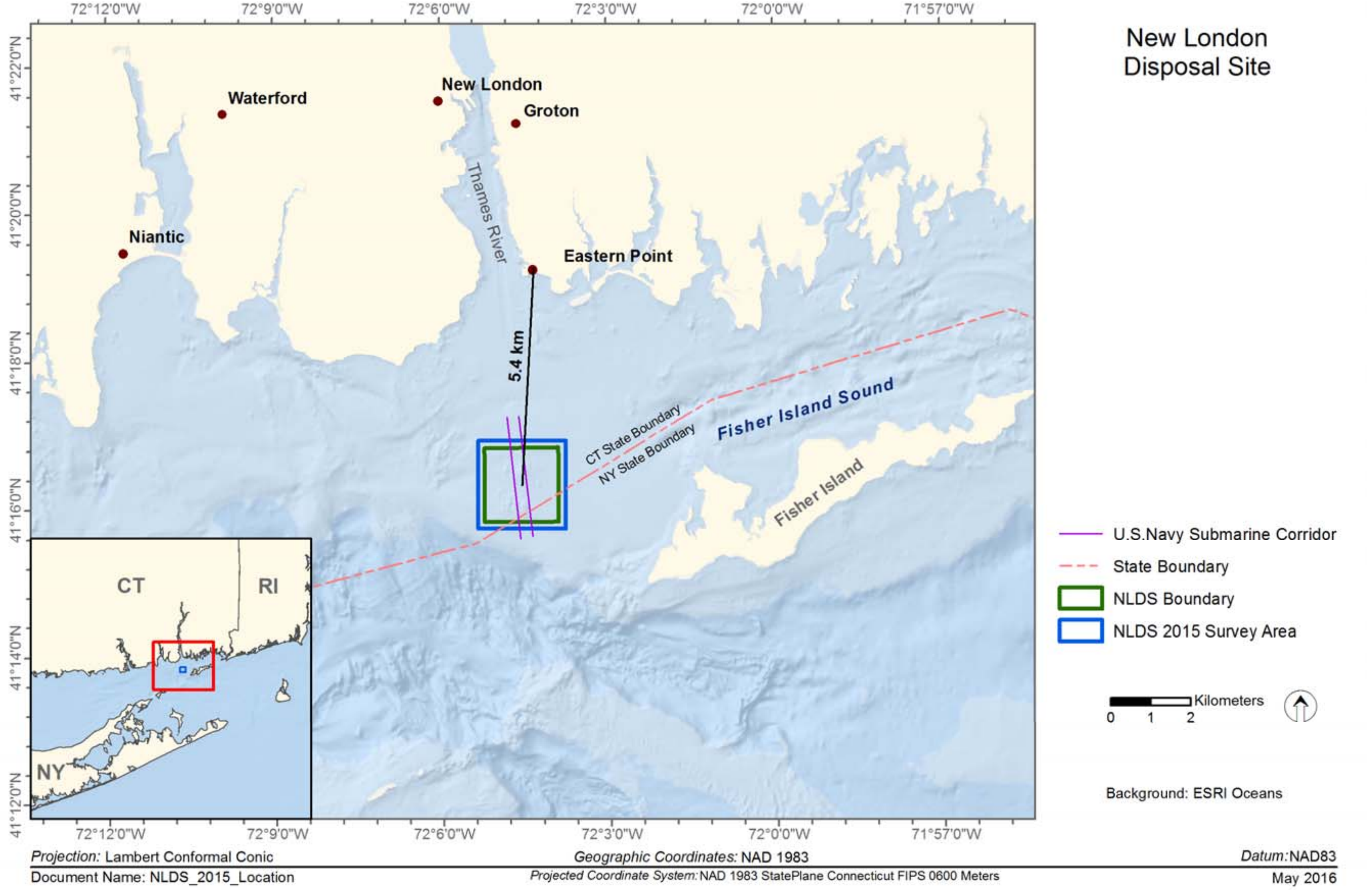

Figure 1-1. Location of the New London Disposal Site (NLDS)

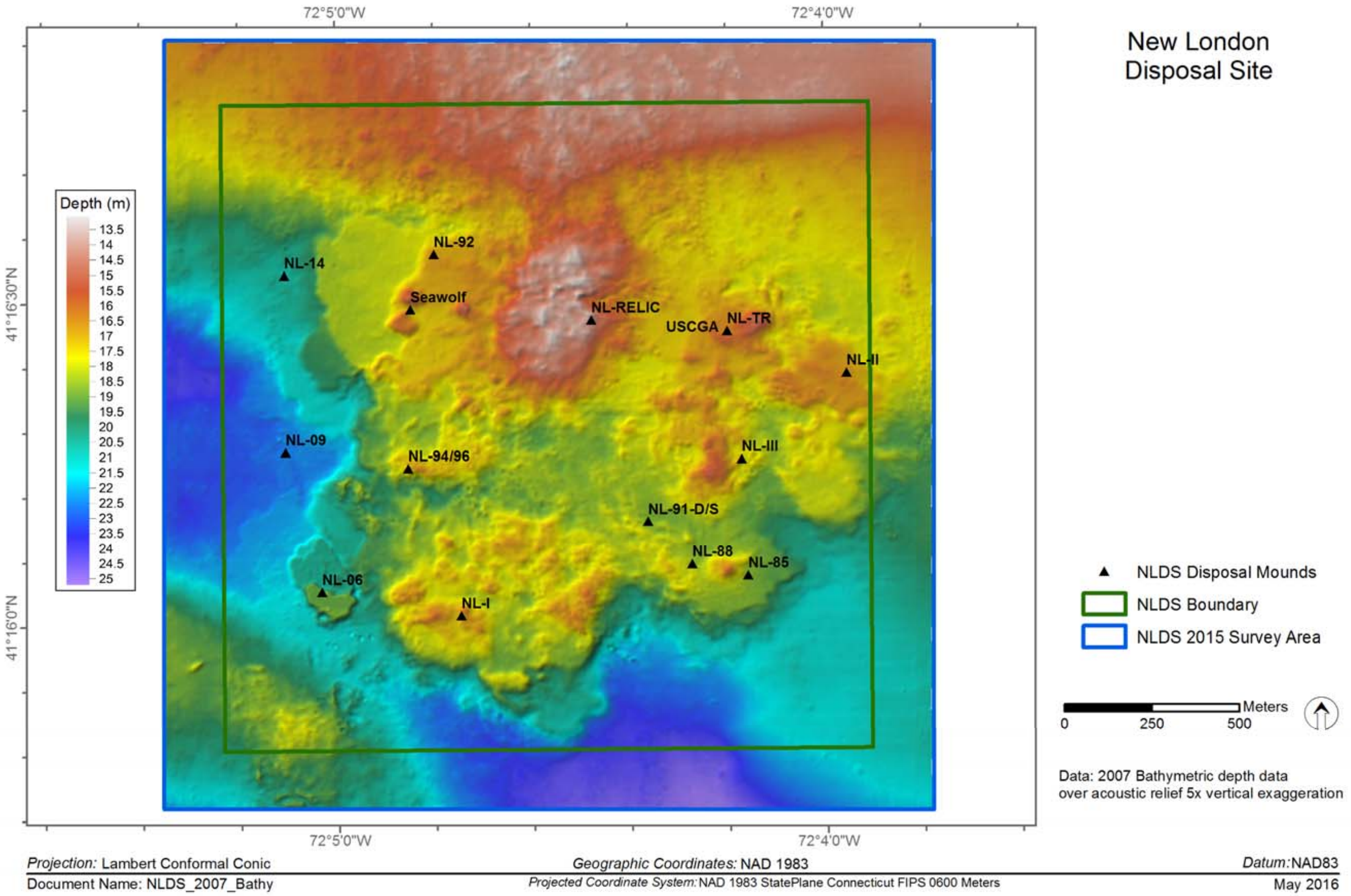

Figure 1-2. Bathymetric depth data over acoustic relief model of NLDS - July 2007

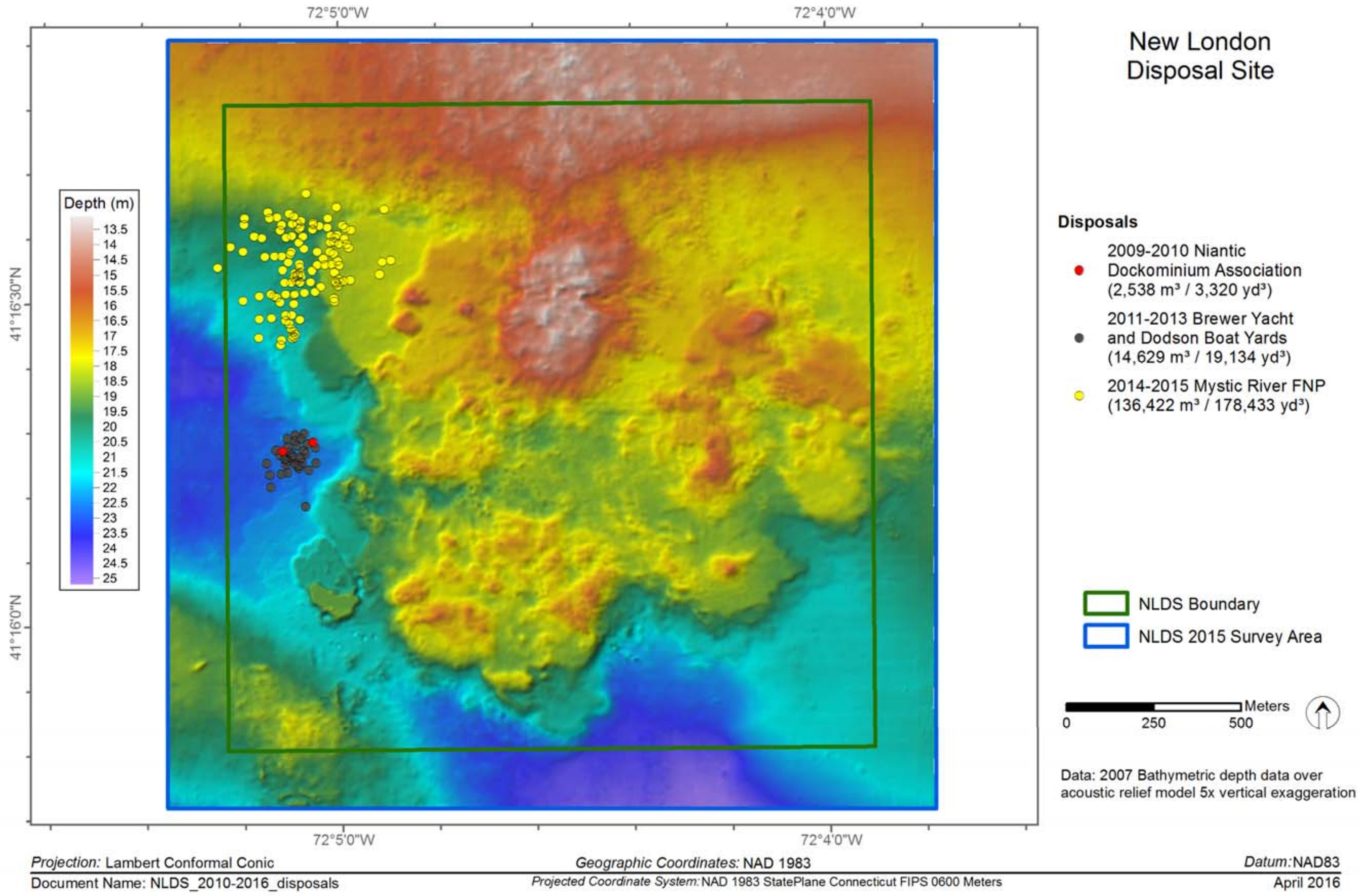

Figure 1-3. Location of reported disposal events at NLDS during disposal seasons 2009-2015

2.0 METHODS

The October 2015 survey at NLDS was conducted by a team of investigators from DAMOSVision (CoastalVision and CR Environmental) aboard the 55-foot R/V *Jamie Hanna*. The acoustic survey was conducted on 15 and 19 October 2015. An overview of the methods used to collect, process, and analyze the survey data is provided below. Detailed Standard Operating Procedures (SOPs) for data collection and processing are available in the Quality Assurance Project Plan for the DAMOS Program (Battelle 2015).

2.1 Navigation and On-Board Data Acquisition

Navigation for the acoustic survey was accomplished using a Hemisphere VS-330 Real-time kinematic Global Positioning System (RTK GPS) which received base station correction through the Keynet NTRIP broadcast. Horizontal position accuracy in fixed RTK mode was approximately 2 cm. A dual-antennae Hemisphere VS110 differential GPS (DGPS) was available if necessary as a backup. The GPS system was interfaced to a desktop computer running HYPACK MAX® hydrographic survey software. HYPACK MAX® continually recorded vessel position and GPS satellite quality and provided a steering display for the vessel captain to accurately maintain the position of the vessel along pre-established survey transects. Vessel heading measurements were provided by an IxBlue Octans III fiber optic gyrocompass.

2.2 Acoustic Survey

The acoustic survey included bathymetric, backscatter, and side-scan sonar data collection. The bathymetric data provided measurements of water depth that, when processed, were used to map the seafloor topography. Backscatter and side-scan sonar data provided images that supported the characterization of surface sediment texture and roughness. Each of these acoustic data types is useful for assessing dredged material placement and surface sediment features.

2.2.1 Acoustic Survey Planning

The acoustic survey featured a high spatial resolution survey of the entire NLDS. DAMOSVision hydrographers coordinated with USACE NAE scientists and reviewed alternative survey designs. For NLDS, a 2200 × 2200 m acoustic survey area was selected. Hydrographers obtained site coordinates, imported them to graphic information system (GIS) software, and created maps to aid planning. Transects spaced 25-30 m apart and cross-lines spaced 300 m apart were created to meet conservative beam angle constraints (Figure 2-1). The survey area and design were then reviewed and approved by NAE scientists.

2.2.2 Acoustic Data Collection

Data layers generated by the survey included bathymetric, acoustic backscatter, and side-scan sonar and were collected using an R2Sonic 2022 broadband multibeam echosounder (MBES). This 200-400 kHz system forms up to 256 1-2° beams (frequency dependent) distributed equiangularly or equidistantly across a 10 - 160° swath. The MBES transducer was mounted amidships to the port rail of the survey vessel using a high strength adjustable boom. The primary GPS antenna was mounted on the transducer boom. The transducer depth below the water surface (draft) and antenna height were checked and recorded at the beginning and end of data acquisition, and the draft was confirmed using the "bar check" method.

An IxBlue Octans III motion reference unit (MRU) was interfaced to the MBES topside processor and to the acquisition computer. Precise linear offsets between the MRU and MBES were recorded and applied during acquisition. Depth and backscatter data were synchronized using pulse-per-second timing and transmitted to the HYPACK MAX® acquisition computer via Ethernet communications. Several patch tests were conducted during the survey to allow computation of angular offsets between the MBES system components.

The system was calibrated for local water mass speed of sound by performing sound velocity profile casts at frequent intervals throughout the survey day using an AML, Inc. Minos-X sound velocity profiler.

2.2.3 Bathymetric Data Processing

Bathymetric data were processed using HYPACK HYSWEEP® software. Processing components are described below and included:

- Adjustment of data for tidal elevation fluctuations
- Correction of ray bending (refraction) due to density variation in the water column
- Removal of spurious points associated with water column interference or system errors
- Development of a grid surface representing depth solutions
- Statistical estimation of sounding solution uncertainty
- Generation of data visualization products

Tidal adjustments were accomplished using RTK GPS. Water surface elevations derived using RTK were adjusted to Mean Lower Low Water (MLLW) elevations using NOAA's VDATUM Model. Processed RTK tide data were successfully ground-truthed against a data series acquired at NOAA's New London Tide Station (#8461490).

Correction of sounding depth and position (range and azimuth) for refraction due to water column stratification was conducted using a series of nineteen sound-velocity profiles acquired by the survey team. Data artifacts associated with refraction remain in the bathymetric surface model at a relatively fine scale (generally less than 5 to 10 cm) relative to the survey depth.

Data acquired in the disposal site portion of the survey area were filtered to accept only beams falling within an angular limit of 55° to minimize refraction artifacts. Spurious sounding solutions were rejected based on the careful examination of data on a sweep-specific basis.

The R2Sonics 2022 MBES system was operated at 249 kHz. At this frequency the system has a beam width of 1.75°. Assuming an average depth of 18 m and a maximum beam angle of 55°, the average diameter of the beam footprint was calculated at approximately 1.0 × 1.7 m (1.6 m^2).

Data were reduced to a cell (grid) size of 2.0 × 2.0 m, acknowledging the system's fine range resolution while accommodating beam position uncertainty. This data reduction was accomplished by calculating and exporting the average elevation for each cell in accordance with USACE recommendations (USACE 2013).

Statistical analysis of data as summarized on Table 2-1 showed negligible tide bias and vertical uncertainty substantially lower than values recommended by USACE (2013) or NOAA (2015). Note that the most stringent National Ocean Service (NOS) standard for this project depth (Special Order 1A) would call for a 95th percentile confidence interval (95% CI) of 0.31 m at the maximum site depth (25.3 m) and 0.29 m at the average site depth (18.8 m).

Reduced data were exported in ASCII text format with fields for Easting, Northing, and MLLW Elevation (meters). All data were projected to the Connecticut State Plane FIPS 0600, NAD83 (metric). A variety of data visualizations were generated using a combination of ESRI ArcMap (V.10.1) and Golden Software Surfer (V.13). Visualizations and data products included:

- ASCII data files of all processed soundings including MLLW depths and elevations
- Contours of seabed elevation (50-cm and 1.0-m intervals) in a geospatial data file (SHP) format suitable for plotting using GIS and computer-aided design software
- 3-dimensional surface maps of the seabed created using 5× vertical exaggeration and artificial illumination to highlight fine-scale features not visible on contour layers delivered in grid and tagged image file (TIF) formats, and
- An acoustic relief map of the survey area created using 5× vertical exaggeration, delivered in georeferenced TIF format.

2.2.4 Backscatter Data Processing

Backscatter data were extracted from cleaned MBES TruePix formatted files then used to provide an estimation of surface sediment texture based on seabed surface roughness. Mosaics of backscatter data were created using HYPACK®'s implementation of GeoCoder software developed by scientists at the University of New Hampshire's NOAA Center for Coastal and Ocean Mapping (UNH/NOAA CCOM). A seamless mosaic of unfiltered backscatter data was developed and exported in grayscale TIF format. Backscatter data were also exported in ASCII format with fields for Easting, Northing, and backscatter (dB). A Gaussian filter was applied to backscatter data to minimize nadir artifacts and the filtered data were used to develop backscatter values on a 1-m grid. The grid was exported as an ESRI binary GRD format to facilitate comparison with other data layers.

2.2.5 Side-Scan Sonar Data Processing

Side-scan sonar data were processed using Chesapeake Technology, Inc. Sonar Wiz software. A seamless mosaic of side-scan sonar data was constructed using SonarWiz to facilitate detailed inspection of sonar imagery. Mosaic resolution was set to 0.1 m × 0.1 m per pixel.

2.2.6 Acoustic Data Analysis

The processed bathymetric grids were converted to rasters, and bathymetric contour lines and acoustic relief models were generated and displayed using GIS. The backscatter mosaics and filtered backscatter grid were combined with acoustic relief models in GIS to facilitate visualization of relationships between acoustic datasets. This is done by rendering images and color-coded grids with sufficient transparency to allow three-dimensional acoustic relief model to be visible underneath.

Table 2-1.

Accuracy and Uncertainty Analysis of Bathymetric Data

		Results (m)		
Survey Date(s)	**Quality Control Metric**	**Mean**	**95% Uncertainty**	**Range**
10/15+19/2015	Cross-Line Swath Comparisons	0.00	0.10	
	Within Cell Uncertainty	0.05	0.08	0.00 - 0.94
	Beam Angle Uncertainty (0 - 50°)	0.00	0.09	0.09 - 0.11

Notes:
1. The mean of cross-line nadir and full swath comparisons are indicators of tide bias.
2. 95% uncertainty values were calculated using the sums of mean differences and standard deviations expressed at the 2-sigma level.
3. Within cell uncertainty values include biases and random errors.
4. Beam angle uncertainty was assessed by comparing cross-line data (55-degree swath limit) with a reference surface created using mainstay transect data.
5. Swath and cell based comparisons were conducted using 2 m x 2 m cell averages. These analyses do not exclude sounding variability associated with terrain slopes

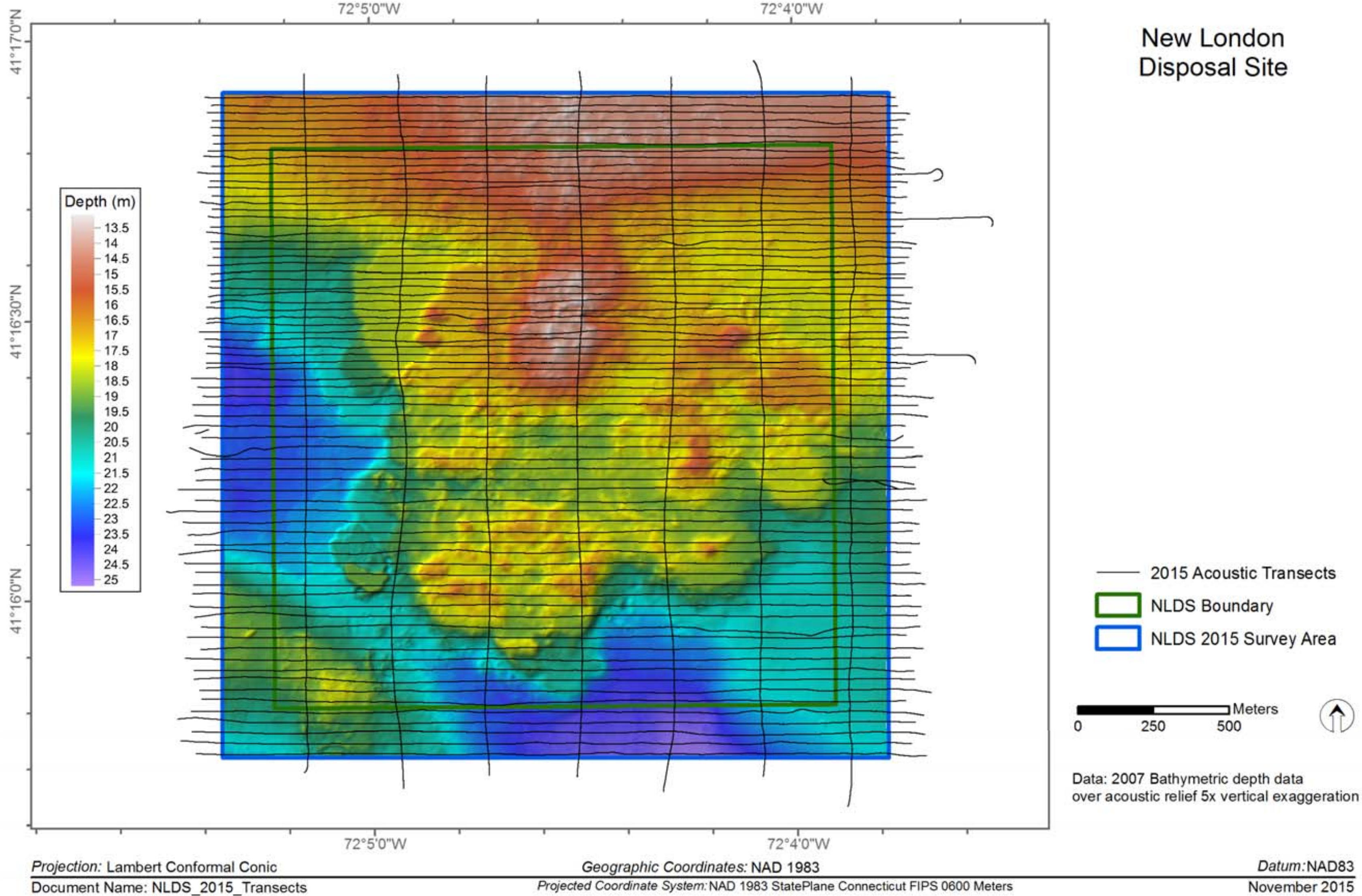

Figure 2-1. NLDS acoustic survey area and transects

3.0 RESULTS

3.1 Acoustic Survey

An acoustic survey was conducted in October 2015 to characterize seafloor topography and surface features over the entire NLDS site.

3.1.1 Bathymetry

The bathymetry of NLDS, as surveyed in 2015, revealed distinct topographic features (Figure 3-1). A large topographic high (NL-RELIC Mound) existed just north of the site center, rising from 3 to 6 m from the surrounding seafloor and extending 375 m east to west and 500 m north to south. The NL-RELIC Mound is bracketed to the west by the Seawolf and NL-92 Mounds, south and east by NL-III, USCGA, and NL-TR Mounds, all of which are of similar height above the seafloor (Figure 3-1). North of NL-RELIC Mound is a shoal of similar height (Figure 3-1). The topographic highs were between 13 to 15 m in depth, near the target depth for disposal mounds; a depth of greater than 14 m limits advection of material by waves and currents at this location (SAIC 2001a, O'Donnell et al. 2015). Each of these topographic highs are relic mounds from past disposal activity at NLDS (Table 1-1). The overall site bathymetry contained water depths ranging from approximately 13 m in depth at the crest of the large NL-RELIC Mound and shoal to the north, to 23 m in depth in the deeper channels to the west and south of the site.

Multibeam bathymetric data rendered as an acoustic relief model provided a more detailed representation of the fine-scale topography (tens of cm relief) of the mounds and of the entire site (Figure 3-2). The majority of the survey area was covered with a rough topographic relief, including the large NL-RELIC Mound just north of the center of NLDS and adjacent smaller mounds. Patterns consistent with placement of dredged material were observed throughout the survey area. The surface texture of NLDS was rough and contained smaller raised isolated mounds, and small circular features (pits with raised rims approximately 35 m in diameter) were also observed. These data also revealed several small crater-like depressions just outside of the NLDS boundary to the north and east of the site. The small cratered regions just north and east of the site boundaries indicate the presence of historical dredged material placement outside of NLDS. Bathymetric data rendered as a color scale over acoustic relief provided additional details of depth and surface texture (Figure 3-3).

3.1.2 Acoustic Backscatter and Side-Scan Sonar

Unfiltered backscatter imagery of the disposal site indicated extensive patterns of dredged material disposal throughout the site. Strong backscatter returns, that indicate rougher or coarse grain sediment, were evident near the western boundary of the site where the 2009 to 2013 disposal activity was targeted (NL-09, Figure 3-4). Medium-strong backscatter was also apparent in the center of the site in the area where the relic disposal mounds exist, as well as in the area of the 2014-2015 disposal events (NL-14, Figure 3-4). Weaker returns were observed in the channels to the west and south, and in the northeast, indicating finer-grained sediment typical of ambient conditions. There were some curved patterns (appearing as curved white lines in Figure 3-4) consistent with release of material while barges were under transport within the site.

Filtered backscatter results, which present a quantitative assessment of surface characteristics independent of slope effects, showed that the weakest sonar returns (-28 to -32 dB), indicating softer sediment, were outside the eastern boundary somewhat independent of depth (depths ranged from 14 to 20 m with little change in backscatter; compare Figure 3-1 to Figure 3-5). Some association with depth was observed for moderate backscatter (-22 to -25 dB) in the areas where the large and small relic disposal mounds (NL-RELIC, NL-I, NL-II, NL-III, NL-85, NL-88, NL-TR, NL-91-D/S Mound Complex, USCGA, NL-92, and Seawolf) were located, generally surrounding the center of NLDS. Stronger backscatter returns occurred in the western area of the site where the 2009 to 2013 disposal activity occurred at NL-09 Mound and was observed as small patches in the center of NLDS across a range of depths (17 to 20 m) in the center of the site surrounding the NL-94/96 Mound.

Side-scan sonar results provided a high-resolution acoustic representation of the seafloor surface in a mosaic of the site (Figure 3-6). Because the side-scan sonar was processed to a 0.1 m x 0.1 m pixel size, close-ups of NL-09 and NL-14 allow for imaging distinct patterns of disposal activity. At NL-14 disposal patterns were patchy, irregular variations of backscatter with low relief (Figure 3-7). At NL-09 disposal patterns were discrete clumps of material with high backscatter and relief (Figure 3-8). These patterns are consistent with the filtered backscatter results (Figure 3-5).

3.1.3 Comparison with Previous Bathymetry

The multibeam data from the 2015 survey was compared with multibeam data collected in August of 2007 (Figure 1-3). A subtraction of the bottom depths in the 2007 survey from the 2015 depths captured the apparent changes in bathymetry since the 2007 survey (Figure 3-9). The most notable difference was the accumulation of sediment in the western and northwestern portions of the survey area at the newly created mounds NL-09 and NL-14. Since 2007 an accumulation of as much as 1.5 m was observed at the targeted area of 2014 to 2015 disposal activity (NL-14 Mound). The area where disposal activity was targeted between 2009 to 2013 was observed to have only 0.4 m of sediment accumulation (NL-09 Mound). Between 2007 and 2015 the majority of NLDS was found to have negative depth differences, ranging from -0.2 to -0.7 m resulting from consolidation. Consolidation was particularly apparent at the NL-06 Mound. Small areas of positive depth differences (~0.2 m) that appeared to correlate with the "pock-marked" craters observed in and around the site are likely to have been artifacts of high relief.

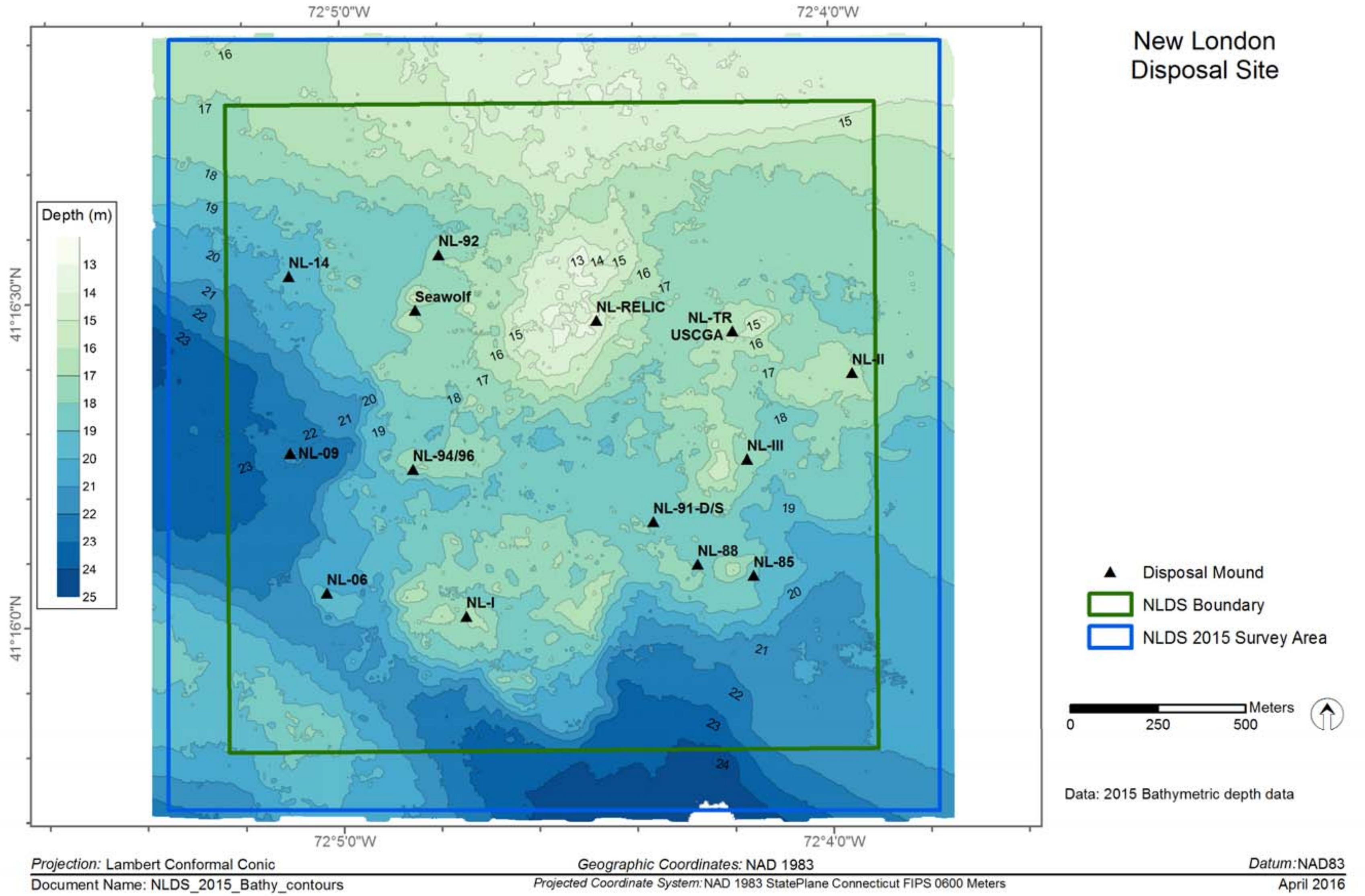

Figure 3-1. Bathymetric contour map of NLDS – October 2015

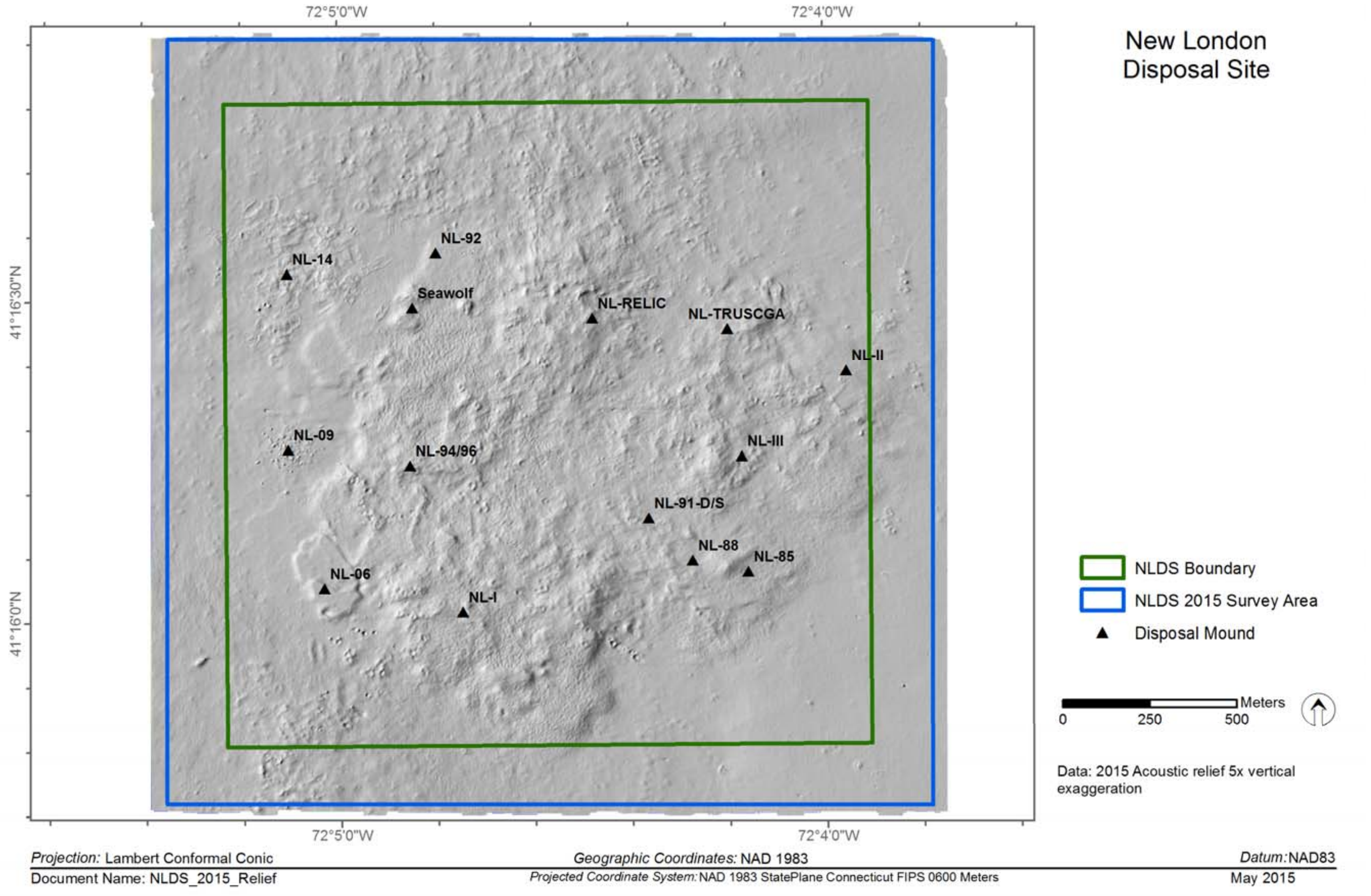

Figure 3-2. Acoustic relief map (hill-shaded grayscale) of NLDS – October 2015

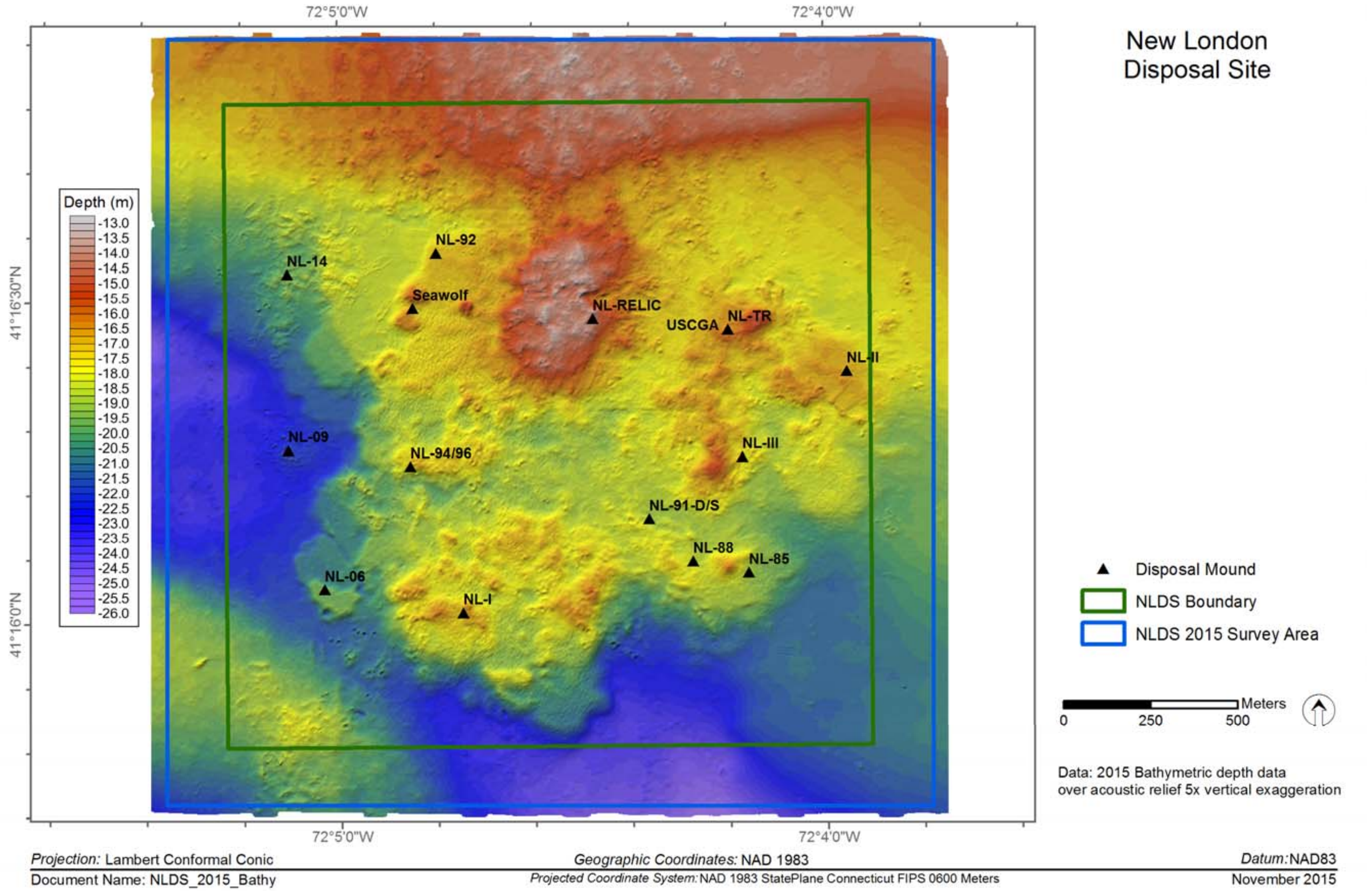

Figure 3-3. Bathymetric depth data over acoustic relief model of NLDS – October 2015

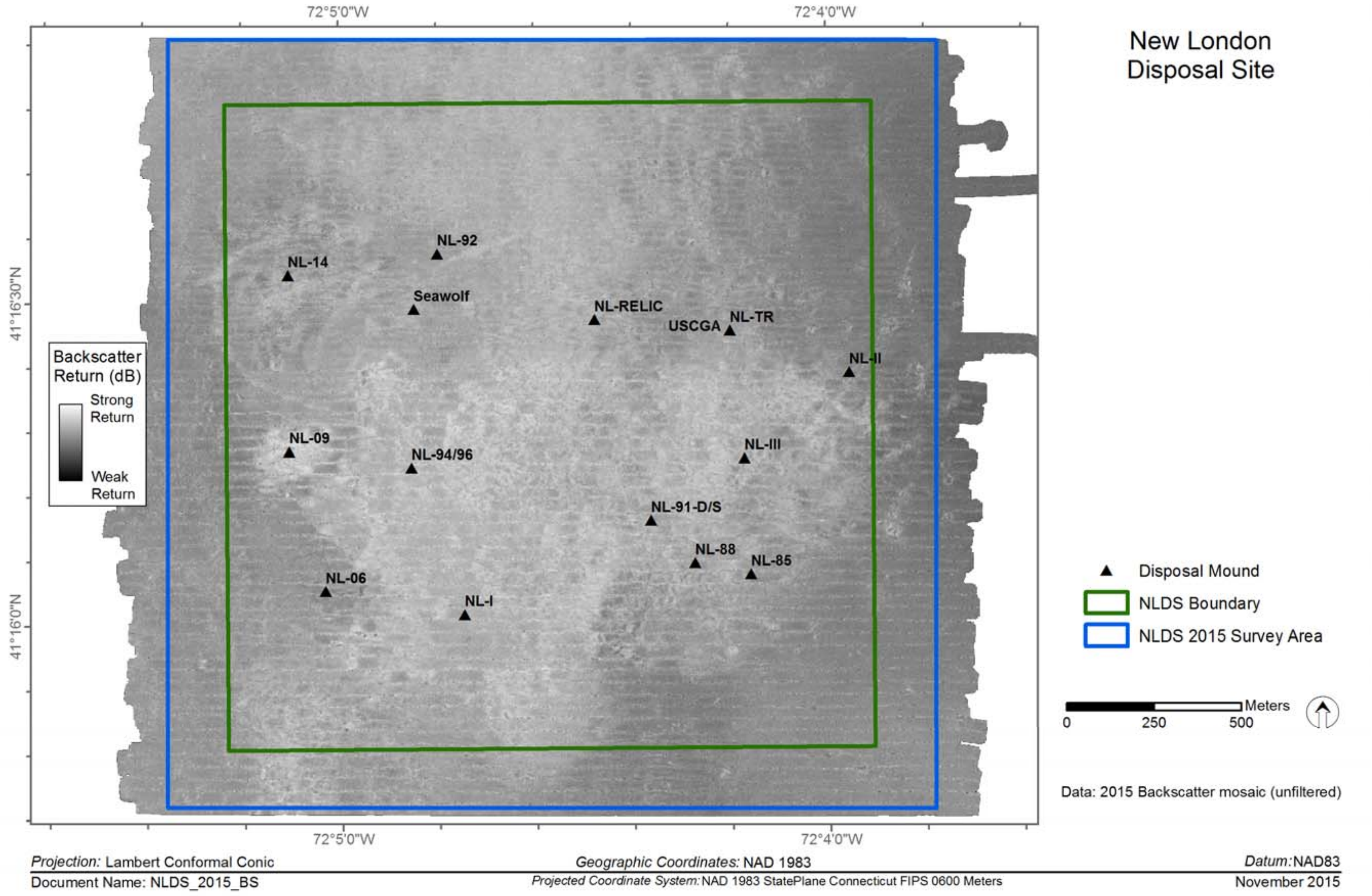

Figure 3-4. Mosaic of unfiltered backscatter data of NLDS – October 2015

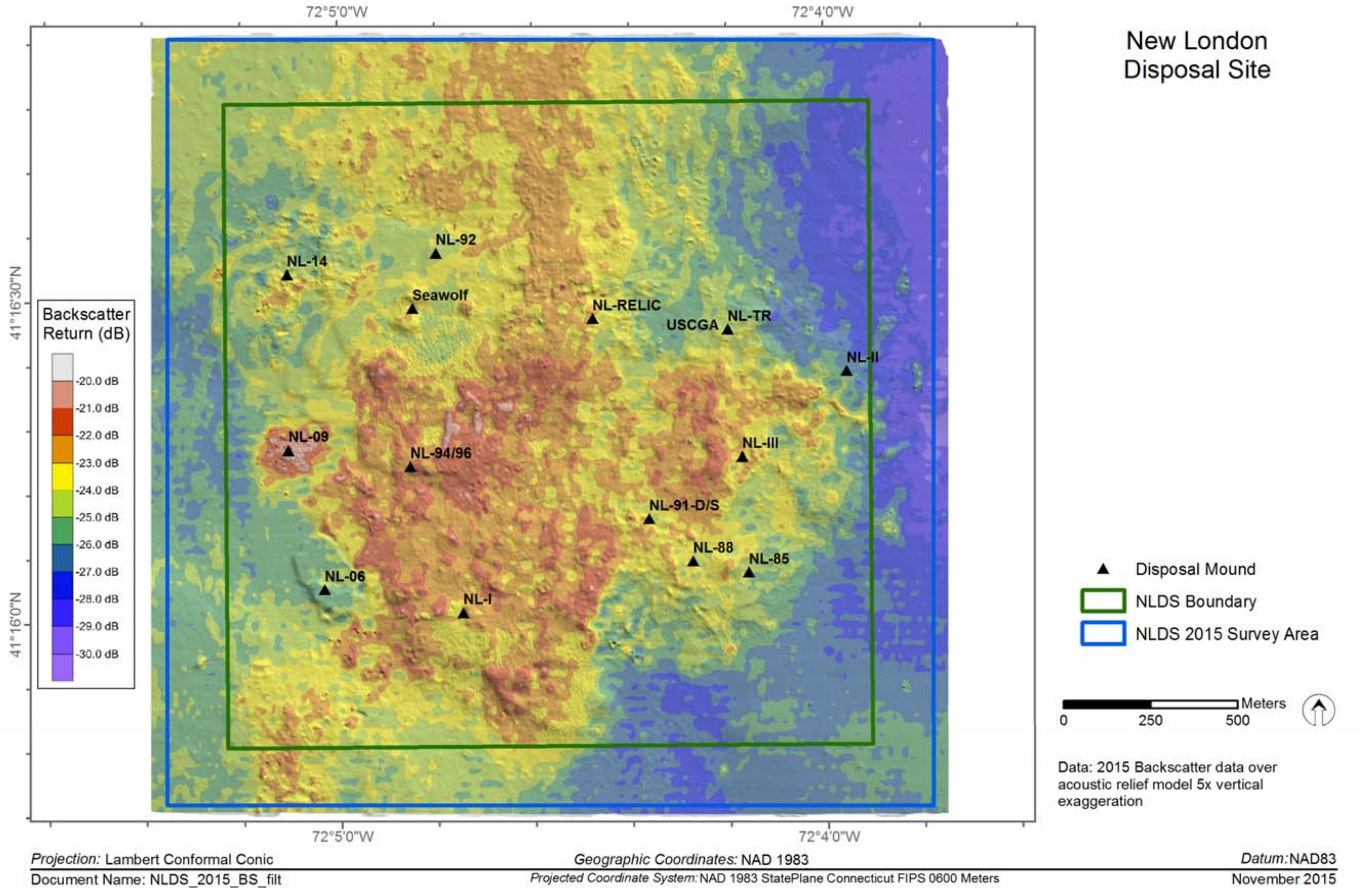

Figure 3-5. Filtered backscatter over acoustic relief model of NLDS – October 2015

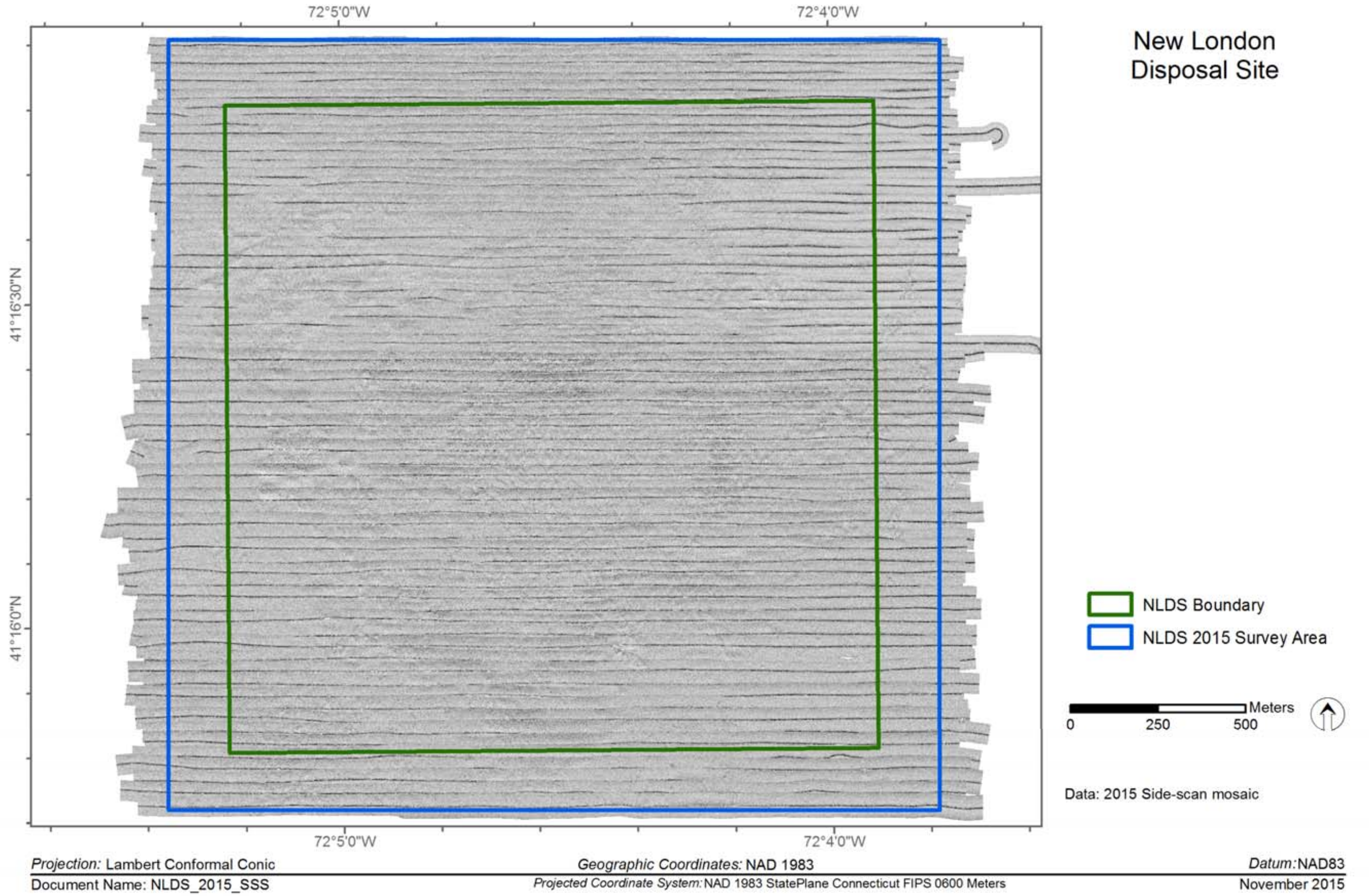

Figure 3-6. Side-scan mosaic of NLDS – October 2015

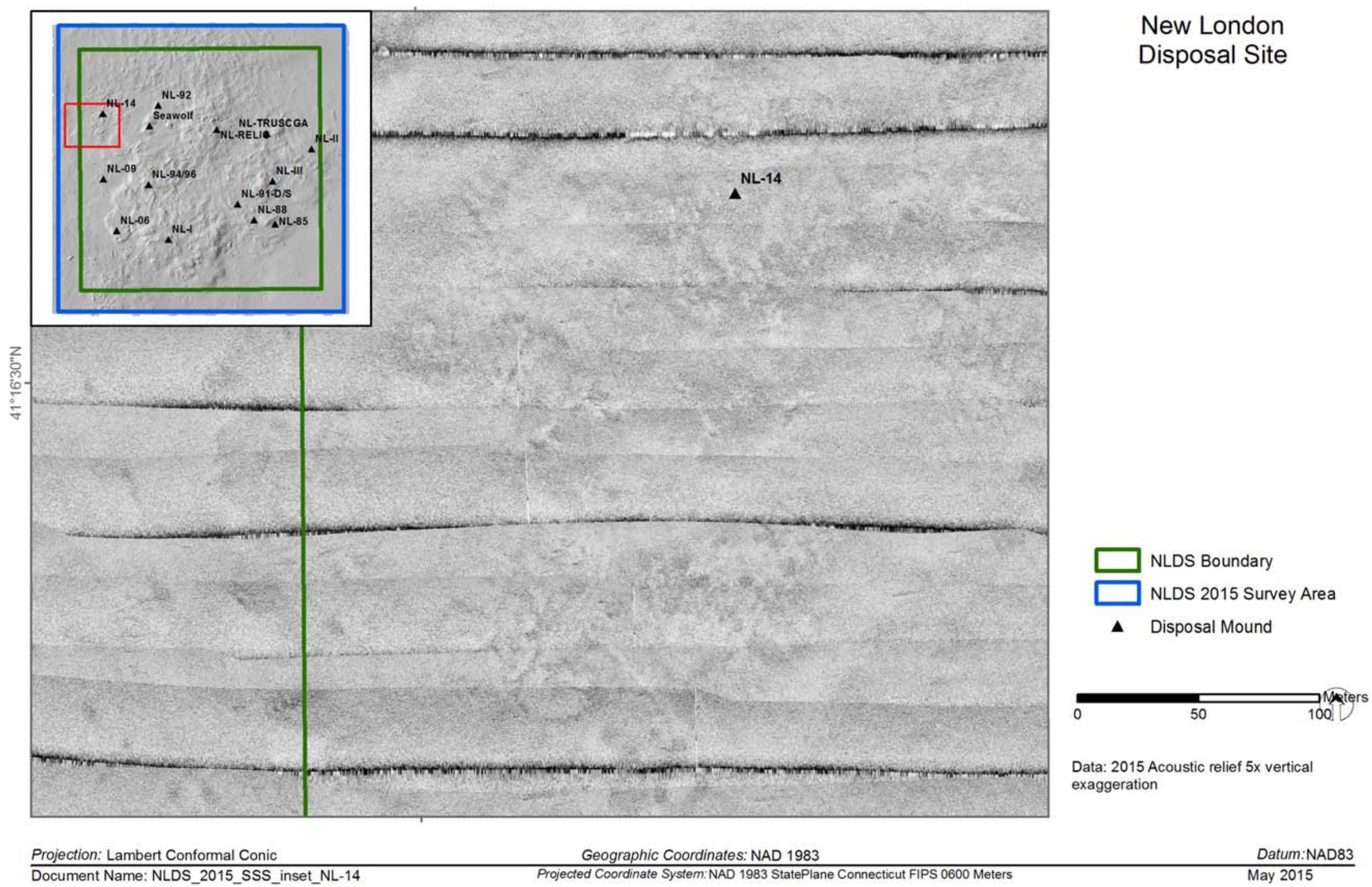

Figure 3-7. Close-up side-scan mosaic of NL-14 Mound at NLDS – October 2015

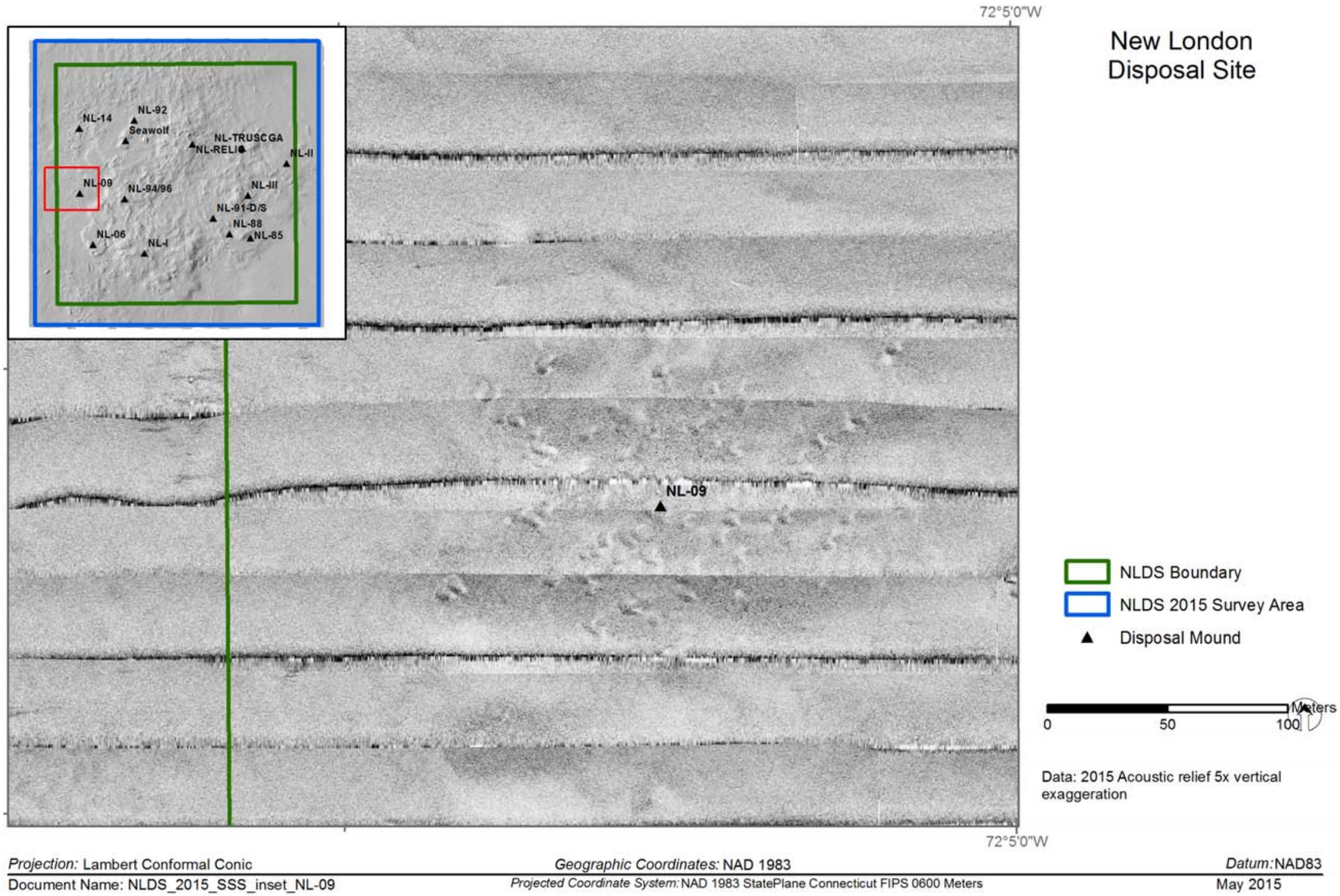

Figure 3-8. Close-up side-scan mosaic of NL-09 Mound at NLDS – October 2015

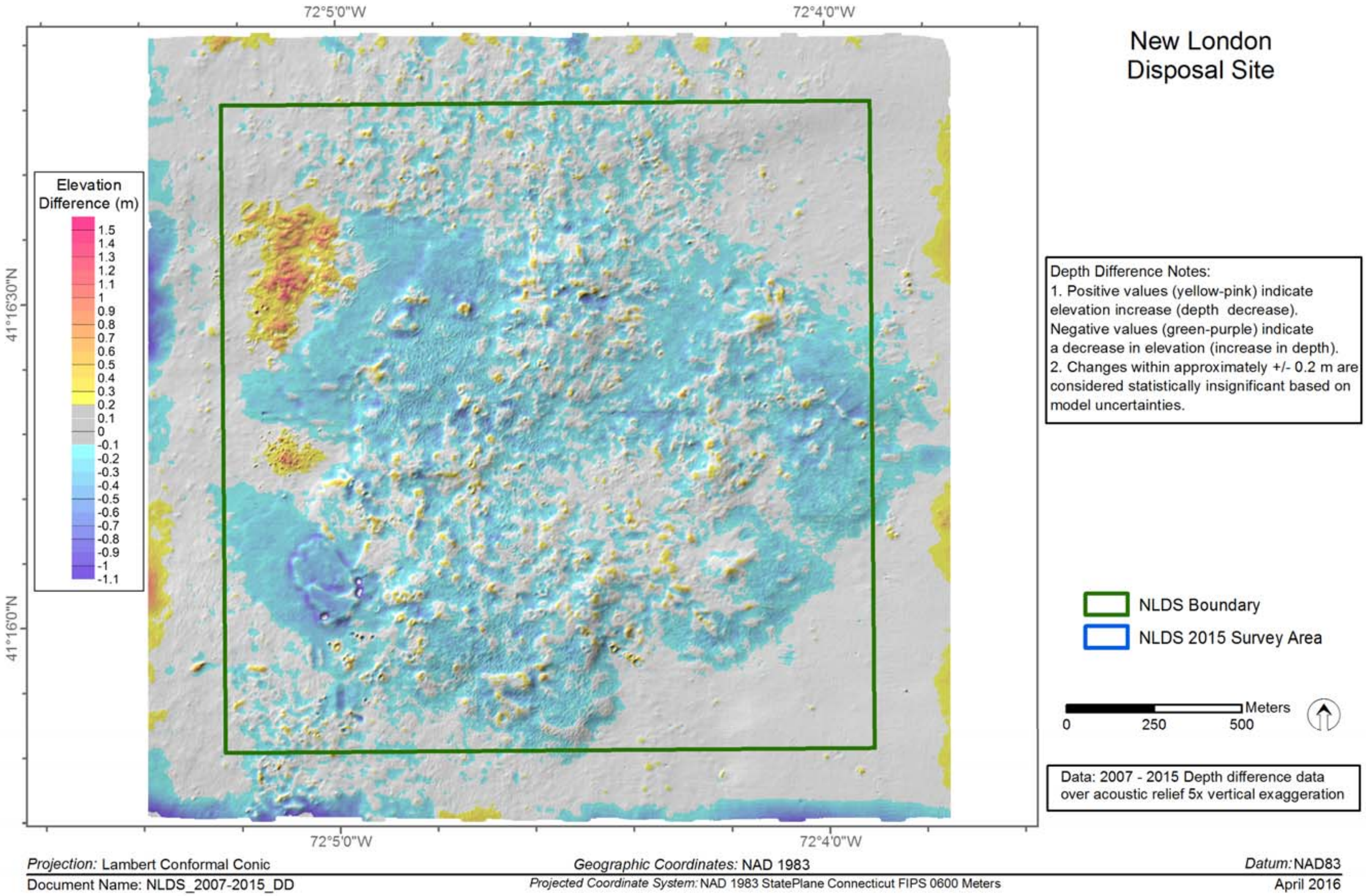

Figure 3-9. NLDS depth difference: 2015 vs. 2007

4.0 SUMMARY

The 2015 acoustic survey at NLDS provided a high resolution bathymetric assessment of the entire disposal site, confirming recent placement of dredged material and assessment of seafloor topography and surface features of new and relic mounds. The 2015 acoustic survey was warranted because 1) there has been limited placement at the site since the last survey in 2007 given the shallow depth over the majority of the site; and 2) there is the potential that a portion or the entire existing site will be closed or expanded in the near future (USEPA 2016).

During the dredging seasons 2009-2015 approximately 155,000 m^3 of dredged material was placed at NLDS, primarily in the deeper western boundary of the site creating two new mounds, NL-09 and NL-14. The bathymetric, backscatter, and side-scan sonar images all confirm successful placement of the dredged material in a broad, flat manner, maintaining a minimum water depth of 14 meters.

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6.0 DATA TRANSMITTAL

Data transmittal to support this data summary report will be provided as a separate deliverable for inclusion in a Technical Support Notebook. The data submittal will include:

- Scope of Work
- Raw and processed acoustic survey data
- Survey field logs
- Report figures and associated files, including an ArcGIS geo-database
- Electronic copies of all final report products

APPENDIX A

TABLE OF COMMON CONVERSIONS

Metric Unit Conversion to English Unit		English Unit Conversion to Metric Unit	
1 meter 1 m	3.2808 ft	1 foot 1 ft	0.3048 m
1 square meter 1 m^2	10.7639 ft^2	1 square foot 1 ft^2	0.0929 m^2
1 kilometer 1 km	0.6214 mi	1 mile 1 mi	1.6093 km
1 cubic meter 1 m^3	1.3080 yd^3	1 cubic yard 1 yd^3	0.7646 m^3
1 centimeter 1 cm	0.3937 in	1 inch 1 in	2.54 cm

APPENDIX B

NLDS DISPOSAL LOG DATA FROM JANUARY 2010 TO JANUARY 2015

Project name	City/town	State	Placement date/time	Load volume (m^3)	Load volume (yd^3)	Placement latitude	Placement longitude	Permit number
Niantic Dockominium Association	Niantic	CT	14-Jan-10	407	532	41.14318	-72.89495	NAE20073143
Niantic Dockominium Association	Niantic	CT	15-Jan-10	419	548	41.14265	-72.89495	NAE20073143
Niantic Dockominium Association	Niantic	CT	17-Jan-10	419	548	41.14305	-72.89533	NAE20073143
Niantic Dockominium Association	Niantic	CT	19-Jan-10	419	548	41.14338	-72.89499	NAE20073143
Niantic Dockominium Association	Niantic	CT	20-Jan-10	431	564	41.27115	-72.08532	NAE20073143
Niantic Dockominium Association	Niantic	CT	21-Jan-10	443	580	41.27138	-72.08427	NAE20073143
Brewer Yacht Yard - Mystic 2012	Mystic	CT	10-Jan-12	324	424	41.27086	-72.08586	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	08-Oct-12	324	424	41.27072	-72.08477	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	09-Oct-12	324	424	41.27069	-72.08443	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	10-Oct-12	324	424	41.27024	-72.08573	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	12-Oct-12	324	424	41.27056	-72.08576	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	17-Oct-12	324	424	41.26973	-72.08454	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	17-Oct-12	324	424	41.27125	-72.08419	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	18-Oct-12	324	424	41.27111	-72.08452	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	20-Oct-12	324	424	41.27086	-72.08417	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	25-Oct-12	324	424	41.27117	-72.08461	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	25-Oct-12	324	424	41.27086	-72.08464	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	26-Oct-12	324	424	41.27148	-72.08516	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	26-Oct-12	324	424	41.27149	-72.08469	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	27-Oct-12	324	424	41.27157	-72.08488	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	01-Nov-12	324	424	41.27161	-72.08456	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	05-Nov-12	324	424	41.27098	-72.08521	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	05-Nov-12	324	424	41.27092	-72.08514	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	06-Nov-12	324	424	41.27083	-72.08520	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	06-Nov-12	324	424	41.27127	-72.08514	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	09-Nov-12	324	424	41.27130	-72.08483	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	11-Nov-12	324	424	41.27114	-72.08507	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	11-Nov-12	324	424	41.27118	-72.08555	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	12-Nov-12	324	424	41.27143	-72.08490	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	12-Nov-12	324	424	41.27135	-72.08446	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	13-Nov-12	324	424	41.27097	-72.08523	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	14-Nov-12	324	424	41.27079	-72.08481	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	14-Nov-12	324	424	41.27058	-72.08535	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	15-Nov-12	324	424	41.27107	-72.08540	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	16-Nov-12	324	424	41.27100	-72.08470	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	16-Nov-12	324	424	41.27080	-72.08474	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	17-Nov-12	324	424	41.27061	-72.08515	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	17-Nov-12	324	424	41.27085	-72.08490	NAE-2008-1547
Brewer Yacht Yard - Mystic 2012	Mystic	CT	18-Nov-12	324	424	41.27100	-72.08503	NAE-2008-1547

Project name	City/town	State	Placement date/time	Load volume (m^3)	Load volume (yd^3)	Placement latitude	Placement longitude	Permit number
Dodson Boat Yard 2012	Stonington	CT	12-Nov-12	1,966	2,571	41.27107	-72.08502	NAE-2006-2960
Dodson Boat Yard 2012	Stonington	CT	13-Nov-12	1,966	2,571	41.27102	-72.08493	NAE-2006-2960
Mystic River FNP 2014-2015	Mystic	CT	03-Dec-14	1,132	1,481	41.27717	-72.08571	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	04-Dec-14	1,132	1,481	41.27649	-72.08307	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	05-Dec-14	1,132	1,481	41.27552	-72.08497	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Dec-14	1,132	1,481	41.27552	-72.08331	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Dec-14	1,132	1,481	41.27456	-72.08470	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Dec-14	1,132	1,481	41.27669	-72.08457	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	08-Dec-14	1,132	1,481	41.27613	-72.08387	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Dec-14	1,132	1,481	41.27565	-72.08487	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	11-Dec-14	1,132	1,481	41.27605	-72.08339	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	13-Dec-14	1,132	1,481	41.27514	-72.08548	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	14-Dec-14	1,132	1,481	41.27702	-72.08493	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	15-Dec-14	1,132	1,481	41.27780	-72.08445	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	15-Dec-14	550	719	40.98460	-73.48210	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	15-Dec-14	1,132	1,481	41.27624	-72.08501	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	16-Dec-14	1,132	1,481	41.27581	-72.08426	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	18-Dec-14	1,132	1,481	41.27666	-72.08598	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	18-Dec-14	1,132	1,481	41.27446	-72.08506	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	19-Dec-14	1,132	1,481	41.27624	-72.08354	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	19-Dec-14	1,132	1,481	41.27522	-72.08568	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	20-Dec-14	1,132	1,481	41.27543	-72.08338	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	20-Dec-14	1,132	1,481	41.27500	-72.08536	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Dec-14	1,132	1,481	41.27671	-72.08495	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Dec-14	1,132	1,481	41.27704	-72.08421	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Dec-14	1,132	1,481	41.27582	-72.85518	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Dec-14	1,132	1,481	41.27566	-72.08462	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Dec-14	1,132	1,481	41.27559	-72.08337	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Dec-14	1,132	1,481	41.27693	-72.08466	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	23-Dec-14	1,132	1,481	41.27715	-72.08371	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	23-Dec-14	1,132	1,481	41.27557	-72.08296	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	24-Dec-14	1,132	1,481	41.27516	-72.08557	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	27-Dec-14	1,132	1,481	41.27685	-72.08535	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	27-Dec-14	1,132	1,481	41.27696	-72.08401	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Dec-14	1,132	1,481	41.27528	-72.08416	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Dec-14	1,132	1,481	41.27468	-72.08497	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Dec-14	1,132	1,481	41.27630	-72.08661	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	30-Dec-14	1,132	1,481	41.27654	-72.08363	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	30-Dec-14	1,132	1,481	41.27617	-72.08588	W912WJ-14-C-0037

Project name	City/town	State	Placement date/time	Load volume (m^3)	Load volume (yd^3)	Placement latitude	Placement longitude	Permit number
Mystic River FNP 2014-2015	Mystic	CT	30-Dec-14	1,132	1,481	41.27597	-72.08359	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	30-Dec-14	1,132	1,481	41.27418	-72.08486	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	31-Dec-14	1,132	1,481	41.27700	-72.08658	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	31-Dec-14	1,132	1,481	41.27688	-72.08424	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	01-Jan-15	1,132	1,481	41.27583	-72.08527	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	01-Jan-15	1,132	1,481	41.27594	-72.08335	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	02-Jan-15	1,132	1,481	41.27414	-72.08494	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	02-Jan-15	1,132	1,481	41.27618	-72.08555	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	03-Jan-15	1,132	1,481	41.27745	-72.08341	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	03-Jan-15	1,132	1,481	41.27589	-72.08469	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	04-Jan-15	1,132	1,481	41.27554	-72.08319	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	04-Jan-15	1,132	1,481	41.27595	-72.08382	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	05-Jan-15	1,132	1,481	41.27551	-72.08520	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	05-Jan-15	1,132	1,481	41.27570	-72.08195	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	05-Jan-15	1,132	1,481	41.27637	-72.08453	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Jan-15	1,132	1,481	41.27671	-72.08361	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Jan-15	1,132	1,481	41.27525	-72.08453	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Jan-15	1,132	1,481	41.27732	-72.08575	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	06-Jan-15	1,132	1,481	41.27640	-72.08301	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Jan-15	1,132	1,481	41.27453	-72.08517	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Jan-15	1,132	1,481	41.27728	-72.08503	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Jan-15	1,132	1,481	41.27689	-72.08469	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Jan-15	1,132	1,481	41.27605	-72.08157	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	07-Jan-15	1,132	1,481	41.27649	-72.08333	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	08-Jan-15	1,132	1,481	41.27603	-72.08508	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	08-Jan-15	1,132	1,481	41.27522	-72.08516	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	08-Jan-15	1,132	1,481	41.27568	-72.08477	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	09-Jan-15	1,132	1,481	41.27456	-72.08469	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	09-Jan-15	1,132	1,481	41.27505	-72.08663	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Jan-15	1,132	1,481	41.27653	-72.08470	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Jan-15	1,132	1,481	41.27663	-72.08316	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Jan-15	1,132	1,481	41.27573	-72.08475	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Jan-15	1,132	1,481	41.27630	-72.08408	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	10-Jan-15	1,132	1,481	41.27407	-72.08496	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	11-Jan-15	1,132	1,481	41.27720	-72.08545	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	11-Jan-15	1,132	1,481	41.27629	-72.08366	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	11-Jan-15	1,132	1,481	41.27556	-72.08481	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	12-Jan-15	1,132	1,481	41.27502	-72.08350	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	12-Jan-15	1,132	1,481	41.27424	-72.08490	W912WJ-14-C-0037

Project name	City/town	State	Placement date/time	Load volume (m³)	Load volume (yd³)	Placement latitude	Placement longitude	Permit number
Mystic River FNP 2014-2015	Mystic	CT	12-Jan-15	1,132	1,481	41.27630	-72.08497	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	12-Jan-15	1,132	1,481	41.27702	-72.08475	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	13-Jan-15	1,132	1,481	41.27666	-72.08347	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	13-Jan-15	1,132	1,481	41.27551	-72.08470	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	14-Jan-15	1,132	1,481	41.27595	-72.08409	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	14-Jan-15	1,132	1,481	41.27409	-72.08611	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	15-Jan-15	1,132	1,481	41.27717	-72.08655	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	16-Jan-15	1,132	1,481	41.27697	-72.08321	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	16-Jan-15	1,132	1,481	41.27496	-72.08489	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	16-Jan-15	1,132	1,481	41.27403	-72.08531	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	17-Jan-15	1,132	1,481	41.27699	-72.08529	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	17-Jan-15	1,132	1,481	41.27692	-72.08374	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	18-Jan-15	1,132	1,481	41.27738	-72.08178	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	18-Jan-15	1,132	1,481	41.27575	-72.08466	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	18-Jan-15	1,132	1,481	41.27577	-72.08350	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	19-Jan-15	1,132	1,481	41.27433	-72.08500	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	19-Jan-15	1,132	1,481	41.27685	-72.08293	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	19-Jan-15	1,132	1,481	41.27460	-72.08567	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	20-Jan-15	1,132	1,481	41.27552	-72.08432	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	20-Jan-15	1,132	1,481	41.27509	-72.08353	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	20-Jan-15	1,132	1,481	41.27411	-72.08489	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Jan-15	1,132	1,481	41.27618	-72.08529	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Jan-15	1,132	1,481	41.27700	-72.08422	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	21-Jan-15	1,132	1,481	41.27551	-72.08466	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Jan-15	1,132	1,481	41.27590	-72.08748	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Jan-15	1,132	1,481	41.27554	-72.08346	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Jan-15	1,132	1,481	41.27391	-72.08535	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	22-Jan-15	1,132	1,481	41.27720	-72.08488	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	23-Jan-15	1,132	1,481	41.27655	-72.08350	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	23-Jan-15	1,132	1,481	41.27520	-72.08488	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	23-Jan-15	1,132	1,481	41.27549	-72.08345	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	24-Jan-15	1,132	1,481	41.27468	-72.08518	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	24-Jan-15	1,132	1,481	41.27667	-72.08513	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	24-Jan-15	1,132	1,481	41.27690	-72.08313	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	25-Jan-15	1,132	1,481	41.27602	-72.08187	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	25-Jan-15	1,132	1,481	41.27575	-72.08485	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	26-Jan-15	1,132	1,481	41.27540	-72.08398	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	26-Jan-15	1,132	1,481	41.27523	-72.08485	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	27-Jan-15	1,132	1,481	41.27517	-72.08607	W912WJ-14-C-0037

Project name	City/town	State	Placement date/time	Load volume (m^3)	Load volume (yd^3)	Placement latitude	Placement longitude	Permit number
Mystic River FNP 2014-2015	Mystic	CT	28-Jan-15	1,132	1,481	41.27458	-72.08608	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	28-Jan-15	1,132	1,481	41.27710	-72.08463	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	28-Jan-15	1,132	1,481	41.27673	-72.08340	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Jan-15	1,132	1,481	41.27670	-72.08623	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Jan-15	1,132	1,481	41.27598	-72.08469	W912WJ-14-C-0037
Mystic River FNP 2014-2015	Mystic	CT	29-Jan-15	1,128	1,475	41.27643	-72.08705	W912WJ-14-C-0037
			TOTAL	**153,589**	**200,887**			